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More stringent measures against COVID-19 are associated with lower cases and deaths in Florida and Miami-Dade

Since the outset of 2020, the COVID-19 pandemic has caused widespread havoc to the lives of millions around the world disrupting families, education, and the employment sector. As of March 26, 2021, the CDC reports over 100 million cases and 2 million deaths worldwide [1]. In Florida, the case study for our research, there have been over 1.7 million cases and over 27,000 deaths. In Florida's most-affected county, Miami-Dade, there have been over 380,000 cases and nearly 5000 deaths.

As the virus spread during the first quarter of 2020, it took repeated urging by public health officials and scholars that mitigation strategies be put into place to stop infection, hospitalizations, and death. These strategies included, among other things, the closure of schools and businesses, the adoption of social distancing measures, the encouragement to use masks, and even more restrictive shelter-in-place or stay-at-home policies. The extent to which the adoption, escalation, and de-escalation of these efforts—regardless of the extent to which individuals abide by such policy proscriptions—has been able to slow or stop the spread of the virus remains a controversial issue among members of the public and even some politicians. To varying degrees both groups continue to thwart implementing and adhering to the restrictions even as cases persist, new variants and strains of the virus take hold, and vaccines begin to be rolled out.

An interesting and important policy question concerns the extent to which efforts aimed at slowing the spread of the virus are implemented in isolation, that is only one or two restrictions, or whether the implementation of several simultaneous restrictions are correlated with a decrease in the spread of the virus, which would be observed in cases, hospitalizations, and deaths.

In this correspondence, we took a close look at this issue. We used *The New York Times* GitHub repository of cases and deaths that is collated from state and local health agency reports as well as the COVID-19 Government Response Stringency Index developed by Oxford University's Blavatnik School of Government for the period between March 11, 2020 and March 26, 2021 [2,3]. The latter is a simple composite score of nine indicators that include: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, "shelter-in-place" and home confinement orders, restrictions on internal movement, restrictions on international travel, and a standardized measure of policy that applies in a general way measured on an ordinal scale and rescaled to vary from 0 to 100 to gauge the appropriateness or effectiveness of a response. These data were transformed in time series for analysis and visualization using R, a language and environment for statistical computing. The results of our work, as applied to the State of Florida and Miami-Dade County, are displayed in Fig. 1.

At the onset of the pandemic, when the stringency-level across the state was at its highest, the overall count was low. The

loosening of stringencies in the period between Memorial Day and Independence Day holiday coincides with the initial surge in transmission. Stringencies across the state reached their lowest during October 2020, the period immediately before the second surge in SARS-CoV-2 cases. The concurrence between the uptick in new infections shortly thereafter and the relaxing of stringencies coupled with the festive period starting with Halloween is striking. Despite a period of elevated mortality in the state between Independence Day and Thanksgiving, the stringency level was reduced greatly.

Drilling down into the Florida's most badly affected county, Miami-Dade, for both cases and deaths the trend is largely reflective of what happened in the state. Indeed, when examining the magnitude of cases, it is clear that not only did roughly a third of all cases in Florida occur in the county, but that the trends are similar. A battery of statistical tests, including the application of a cross-correlation function used to determine if the lag of one time series predicts another time series, were performed. The results for these comparisons were compelling as they indicated changes in stringency index were significantly predictive of changes in the incidence of cases between 10 and 17 days later. In particular, results of the Pearson correlation, based on time series that were detrended to make each series stationary, provides clear evidence of what we have attempted to convey in our correspondence, that is, a significant negative relationship between daily cases and mortality and the level of stringency in place. Put differently, as the level of stringency goes down, we would predict cases and deaths go up.

These findings on the coincidence between stringency levels and both cases and deaths, at the State and county-specific level have particular relevance to policy-makers and public health officials as it provides some initial evidence about the relative success of broadly adopted, government led public health measures in the State of Florida meant to curb the spread of the disease over time.

Although our exploratory inquiry that focuses on a singular county and state is not meant to be a causal analysis and therefore cannot rule out potential confounding factors that may better explain the relationship in the figure or the potential generalizability of such a relationship across all counties in the U.S., it is striking how the adoption of more stringent policy measures aimed at attenuating COVID-19 largely coincides with fewer cases and deaths.

We recognize that it is difficult for policymakers and politicians to 'shut down' everything, especially schools and businesses—which have taken their toll on student progress, mental health, and shuttered businesses resulting in exceedingly high unemployment. Despite this, efforts should be made to strike a balance for the period of time necessary, and where necessary, to slow the spread of the virus until the vast majority of individuals can be vaccinated. To strike this balance, we must better and more completely understand the juxtaposition between broad-scale stringencies and the contagion process, as the evidence-base around what works as a successful strategy that can be implemented by policymakers for slowing or stopping the spread of transmission remains unclear.

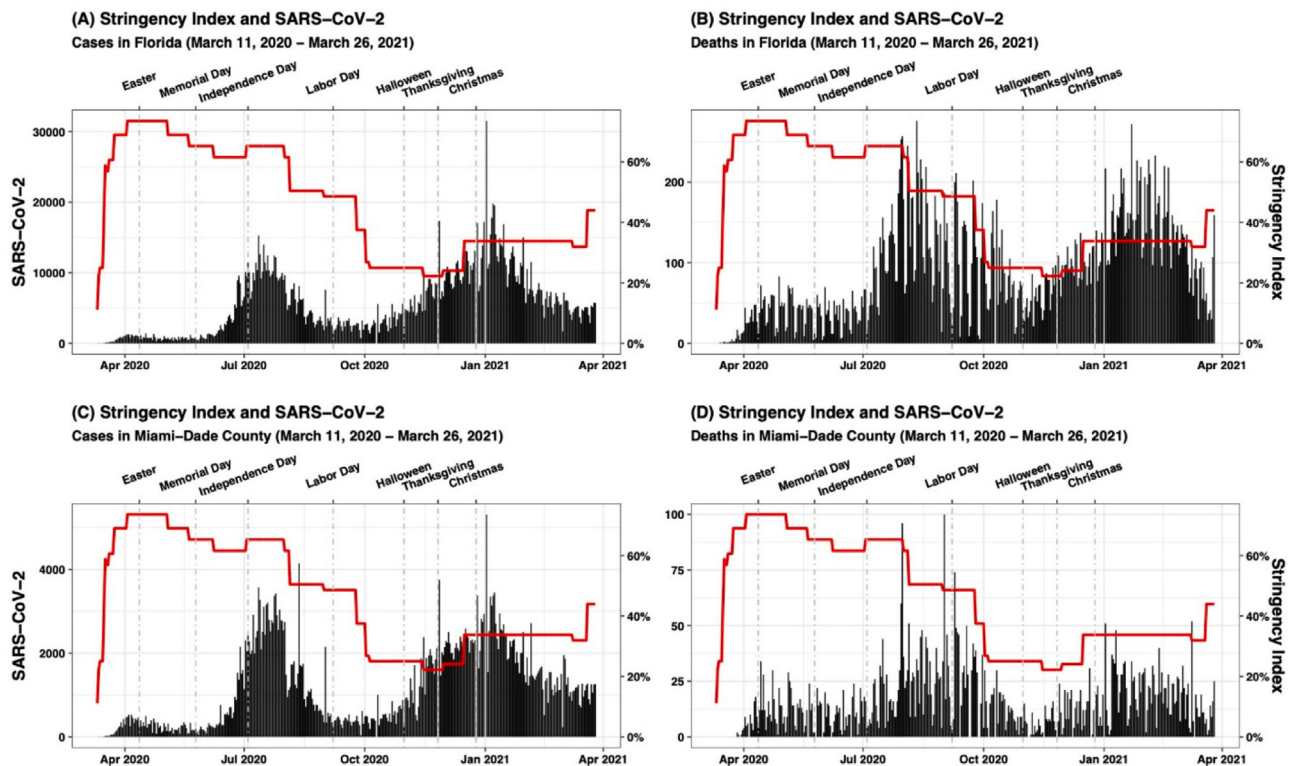


Fig. 1. A. (upper-left panel) is a bar plot of the daily count of SARS-CoV-2 cases in the State of Florida plotted against the time series of the stringency index, where 0% represents no closure or containment effort and 100% is indicative of the most stringent approach that can be adopted by government. C. (lower-left) is the same for Miami-Dade county. B. (upper-right panel) shifts to the daily count of SARS-CoV-2 deaths in the state plotted against the stringency index. D. is the same for Miami-Dade county.

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